

AMPHIBIA: CAUDATA: PLETHODONTIDAE

Plethodon angusticlavius

Catalogue of American Amphibians and Reptiles.

Meshaka, W.E., Jr. and S.E. Trauth. 2006. *Plethodon angusticlavius*.

***Plethodon angusticlavius* Grobman
Ozark Zigzag Salamander**

Plethodon cinereus: Dunn 1926:153.

Plethodon dorsalis: Black and Dellinger 1938:7.

Plethodon cinereus angusticlavius Grobman 1944: 266. Type-locality, "at Mud Cave, near Fairy Cave, Stone County, Missouri." Holotype, American Museum of Natural History (AMNH) 40366, an adult male collected by B.C. Marshall, 1 October 1927 (not examined by authors).

Plethodon dorsalis angusticlavius: Thurnow 1956:177.

Plethodon dorsalis dorsalis: Conant 1958:231 (part).

Plethodon dorsalis angusticlavius: Wiley 1968:137. *Lapsus*.

Plethodon angusticlavius: Collins 1991:43. See **Nomenclatural History**.

• **CONTENT.** *Plethodon angusticlavius* is a monotypic species.

• **DEFINITION.** *Plethodon angusticlavius* is a small, dark woodland salamander. Sexual maturity is attained at about 30 mm SVL. Females are slightly larger than males in Arkansas (mean SVL = 39.2 mm for males, 41.3 mm for females; Meshaka and Trauth 1995) and Missouri (SVL from 30–42 mm for males, 32–45 mm for females; Wilkinson et al. 1993). The maximum total length reported is 98 mm, with adults ranging from 69–98 mm (Conant and Collins 1998). The largest *P. angusticlavius* reported from Missouri measured 81 mm TL (Powell et al. 1982). Nasolabial grooves are present. Costal grooves range from 17–19 (Johnson 2000). The vomerine teeth range from 8–16 (Trauth et al. 2004) and the mandibular teeth average 46.6 (Atwill and Trauth 1988).

The species has a generally incomplete but conspicuous, narrow, middorsal stripe. The color of the stripe can be red, yellow, or orange. The width of the stripe is usually less than one-third the width of the body and is widest near the hind legs. The dorsal stripe is only roughly straight-edged and may appear as a long diamond-shaped spot near the hind legs (Thurnow 1966). Occasionally, individuals are found without a dorsal stripe. The sides are dark gray with some orange or white flecks. The belly is white with black mottling, and red chromatophores are evident on the bellies of living animals.

• **DIAGNOSIS.** *Plethodon serratus* is allopatric with *P. angusticlavius* in Oklahoma (Black and Sievert 1989), Missouri (Johnson 2000), and Arkansas (Trauth et al. 2004). The belly of *P. serratus* is not mottled with black and white (Conant and Collins 1991, 1998, Johnson 2000, Trauth et al. 2004). *Plethodon angusticlavius* has a reduced dorsal stripe or a complete dorsal stripe that lacks lobes as pronounced

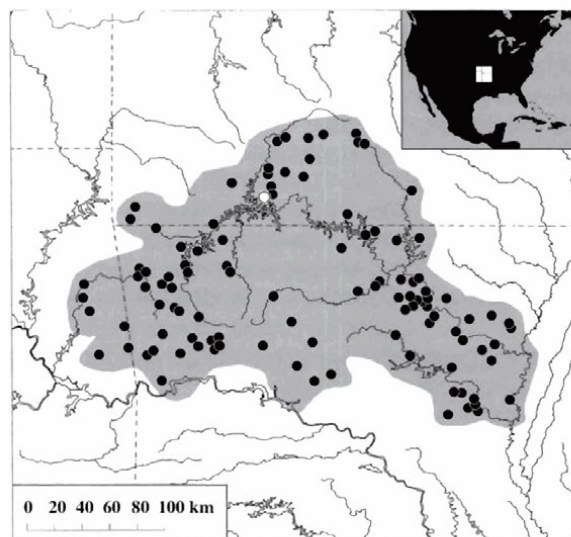


Figure 1. Adult *Plethodon angusticlavius* from Stone County, Arkansas (photograph by Stan Trauth).

as in *P. dorsalis* (Conant and Collins 1998).

• **DESCRIPTIONS.** Descriptions include Grobman (1944), Thurnow (1956, 1957), Highton (1962), Johnson (1977, 1987, 2000), and Trauth et al. (2004).

• **ILLUSTRATIONS.** Color photographs of adult *P. angusticlavius* were provided by Black and Sievert (1989), Johnson (1987, 2000), and Trauth et al. (2004). A black-and-white photograph is in Johnson (1977). Line drawings are in Conant (1975), Conant and Collins (1991, 1998), Grobman (1944), and Wiley (1968). Thurnow (1957) and Trauth et al. (2004) included line drawings of the dorsum.



Map. Distribution of *Plethodon angusticlavius*: the circle indicates the type-locality and dots mark other known locality records.

• **DISTRIBUTION.** *Plethodon angusticlavius* is restricted to the Ozark Plateau Province in northeastern Oklahoma, western Arkansas, and southern Missouri (Hurter 1911, Dunn 1926, Stejneger and Barbour 1917, 1923, 1933, 1939, 1943, Black and Dellinger 1938, Bishop 1943, Grobman 1944, Dowling 1957, Thurnow 1966, Johnson 1977, 1987, Black and Sievert 1989, Conant and Collins 1991, 1998, Johnson 2000, Meshaka 2005, Trauth et al. 2004, and Daniel and Edmond 2005).

FOSSIL RECORD. None.

• **PERTINENT LITERATURE.** Published literature on this species includes the following: **behavior** (Meshaka and Trauth 1995, Maksimowich 1998, Maksimowich and Mathis 2000, 2001, Mathis and Britzke 1999, Mathis et al. 2000, Watson 2001, Briggler and Puckette 2003, Watson et al. 2004, and Picard 2005), **diet** (Britton 1981), **ecology** (Briggler and Prather 2006), **general accounts** (Thurrow 1966, Conant 1975, Johnson 1977, 1987, 2000, Black and Sievert 1989, Conant and Collins 1991, 1998, Petranksa 1998, Wiggs and Angelo 2003, Meshaka 2005, and Trauth et al. 2004), **habitat** (Thurrow 1957, Myers 1958, Highton 1962, Britton 1981, and Meshaka and Trauth 1995), **keys** (Powell et al. 1998 and Wiley 1968), **morphology** (Atwill and Trauth 1988), **parasites** (Maksimowich 1998, Maksimowich and Mathis 2000, 2001), **reproduction** (Wilkinson et al. 1993, Meshaka and Trauth 1995, and Briggler and Puckette 2003), **size and growth** (Meshaka and Trauth 1995, Edmond and Daniel 2001), **taxonomy and systematics** (Grobman 1944, Thurrow 1956, 1957, Larsen and Highton 1978, Highton 1962, 1995, 1997, and Maxson et al. 1984).

• **NOMENCLATURE HISTORY.** Much confusion regarding the status of this species is attributable to uncertainty regarding relationships within the *Plethodon dorsalis* species complex (*sensu* Highton 1997). Originally described as a subspecies of *P. cinereus*, Thurrow (1956) reassigned it to *P. dorsalis*. Conant (1958) did not recognize it at all, subsuming it in *P. dorsalis dorsalis*, although Conant (1975) and Conant and Collins (1991, 1998) retained it as *P. dorsalis angusticlavius*. Collins (1991), in a proposal to elevate this taxon to full species status, first used the name *P. angusticlavius*. That change was not widely accepted until Highton (1997) formally elevated the taxon.

• **ETYMOLOGY.** The Latin name *angusticlavius* means "wearing a narrow stripe."

• **COMMENT.** Because of the considerable confusion regarding relationships among the *Plethodon cinereus* and *P. dorsalis* species complexes, references to populations currently considered to be *P. angusticlavius* may be subsumed under various names in older publications. Since sympatry with congeners is limited to the much larger *P. albagula*, and it is allopatric with the similar sized *P. serratus* along northern and western boundaries of its range, an opportunity exists here to test predictions associated with competition. This species is suitable as a sensitive and easily measured ecological barometer of deciduous forest and cedar glade perturbations (Meshaka 2005).

• **ACKNOWLEDGEMENTS.** We thank R. Daniels for distributional records from Missouri and the staff at the Sam Noble Museum of Natural History for collection records from Oklahoma.

LITERATURE CITED

- Atwill, R.A. and S.E. Trauth. 1988. Mandibular dentition in six species of salamanders, genus *Plethodon* (Caudata: Plethodontidae), from Arkansas using scanning electron microscopy. *Proc. Arkansas Acad. Sci.* 42:24–25.
- Bishop, S.C. 1943. A Handbook of Salamanders. Comstock Publ., Ithaca, New York.
- Black, J.D. and S.C. Dellinger. 1938. Herpetology of Arkansas. Part Two: The amphibians. *Occ. Pap. Univ. Arkansas Mus.* (2):1–30.
- Black, J.H. and G. Sievert. 1989. A Field Guide to Amphibians of Oklahoma. Oklahoma Dept. of Wildl. Conserv., Oklahoma City.
- Briggler, J.T. and J.W. Prather. 2006. Seasonal use and selection of caves by plethodontid salamanders in a karst area of Arkansas. *Amer. Midl. Nat.* 155:136–148.
- and W.L. Puckette. 2003. Observations on the reproductive biology and brooding behavior of the Ozark Zigzag Salamander, *Plethodon angusticlavius*. *Southwest. Nat.* 48:96–100.
- Britton, J.M. 1981. Microhabitat distribution and its effect on prey utilization in sympatric populations of *Plethodon glutinosus* and *Plethodon dorsalis* in northwestern Arkansas. *Proc. Arkansas Acad. Sci.* 35:26–28.
- Collins, J.T. 1991. Viewpoint: a new taxonomic arrangement for some North American amphibians and reptiles. *Herpetol. Rev.* 22:42–43.
- Conant, R. 1958. A Field Guide to Reptiles and Amphibians of the United States and Canada East of the 100th Meridian. Houghton Mifflin Co. Boston, Massachusetts.
- . 1975. A Field Guide to the Reptiles and Amphibians of Eastern and Central North America. 2nd ed. Houghton Mifflin Co., Boston, Massachusetts.
- and J.T. Collins. 1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. 3rd ed. Houghton Mifflin Co., Boston, Massachusetts.
- and –. 1998. A Field Guide to Reptiles and Amphibians of Eastern and Central North America. 3rd ed. Houghton Mifflin Co., Boston.
- Daniel, R. and B. Edmond. 2004. Atlas of Missouri Amphibians and Reptiles. <<http://atlas.moherp.org/>> Accessed 27 January 2005.
- Dowling, H.G. 1957. A review of the amphibians and reptiles of Arkansas. *Occ. Pap. Univ. Arkansas Mus.* (3):1–51.
- Dunn, E.R. 1926. The Salamanders of the Family Plethodontidae. Smith College, Northampton, Massachusetts.
- Edmond, B.S. and R.E. Daniel. 2001. Maximum size records for amphibians and reptiles from Missouri. *Missouri Herpetol. Assoc. Newsl.* (14):15–16.
- Grobman, A.B. 1944. The distribution of the salamanders of the genus *Plethodon* in the eastern United States and Canada. *Ann. New York Acad. Sci.* 45:261–316.
- Highton, R. 1962. Revision of North American sala-

- manders of the genus *Plethodon*. Bull. Florida St. Mus., Biol. Ser. 6:235–367.
- . 1995. Speciation in eastern North American salamanders of the genus *Plethodon*. Ann. Rev. Ecol. Syst. 26:579–600.
- . 1997. Geographic protein variation and speciation in the *Plethodon dorsalis* complex. Herpetologica 53:345–356.
- Hurter, J. 1911. Herpetology of Missouri. Trans. St. Louis Acad. Sci. 20:59–274.
- Johnson, T.R. 1977. The Amphibians of Missouri. Univ. Kansas Mus. Nat. Hist. Publ. Educ. Ser. (6): x + 134 p.
- . 1987. The Amphibians and Reptiles of Missouri. Missouri Dept. Conserv., Jefferson City.
- . 2000. The Amphibians and Reptiles of Missouri. 2nd ed. Missouri Dept. Conserv., Jefferson City.
- Larson, A. and R. Highton. 1978. Geographic protein variation and divergence in salamanders of the *Plethodon welleri* group (Amphibia, Plethodontidae). Syst. Zool. 27:431–448.
- Maksimowich, D.S. 1998. A role for parasites in the behavior of the Ozark Zig-Zag Salamander (*Plethodon angusticlavius*). M.S. Thesis, Southwest Missouri St. Univ., Springfield.
- and A. Mathis. 2000. Parasitized salamanders are inferior competitors for territories and food resources. Ethology 106:319–329.
- and –. 2001. Pheromonal markers as indicators of parasite load: parasite-mediated behavior in salamanders (*Plethodon angusticlavius*). Acta Ethol. 3:83–87.
- Mathis, A. and E. Britzke. 1999. The roles of body size and experience in agonistic displays of the Ozark Zigzag Salamander, *Plethodon angusticlavius*. Herpetologica 55:344–352.
- , D.W. Schmidt, and K.A. Medley. 2000. The influence of residency status on agonistic behavior of male and female Ozark Zigzag Salamanders *Plethodon angusticlavius*. Amer. Midl. Nat. 143: 245–249.
- Maxson, L.R., R. Highton, and D. Ondrula. 1984. Immunological evidence on genetic relationships of *Plethodon dorsalis*. J. Herpetol. 18:341–344.
- Meshaka, W.E., Jr. 2005. *Plethodon angusticlavius*, p. 790–791. In M. Lannoo (ed.), Status and Conservation of North American Amphibians. Univ. California Press, Berkeley.
- and S.E. Trauth. 1995. Reproductive cycle of the Ozark Zigzag Salamander, *Plethodon dorsalis angusticlavius* (Caudata, Plethodontidae), in north central Arkansas. Alytes 12:175–182.
- Myers, C.W. 1958. Amphibians in Missouri caves. Herpetologica 14:35–36.
- Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian. Inst. Press, Washington, D.C.
- Picard, A.L. 2005. Courtship in the Zig-Zag Salamander (*Plethodon dorsalis*): insights into a transition in pheromone-delivery behavior. Ethology 111:799–809.
- Powell, R., K.P. Bromeier, N.A. Laposha, J.S. Parmelee, Jr., and B. Miller. 1982. Maximum sizes of amphibians and reptiles from Missouri. Trans. Missouri Acad. Sci. 16:99–106.
- , J.T. Collins, and E.D. Hooper, Jr. 1998. A Key to Amphibians and Reptiles of the Continental United States and Canada. Univ. Kansas Press, Lawrence.
- Stejneger, L. and T. Barbour. 1917. A Checklist of North American Amphibians and Reptiles. Harvard Univ. Press, Cambridge.
- and –. 1923. A Checklist of North American Amphibians and Reptiles. 2nd ed. Harvard Univ. Press, Cambridge.
- and –. 1933. A Checklist of North American Amphibians and Reptiles. 3rd ed. Harvard Univ. Press, Cambridge.
- and –. 1939. A Checklist of North American Amphibians and Reptiles. 4th ed. Harvard Univ. Press, Cambridge.
- and –. 1943. A Checklist of North American Amphibians and Reptiles. 5th ed. Harvard Univ. Press, Cambridge.
- Thurrow, G.R. 1956. Comparisons of the two species of salamanders, *Plethodon cinereus* and *Plethodon dorsalis*. Herpetologica 12:177–182.
- . 1957. Relationships of the red-backed and zig-zag plethodons in the west. Herpetologica 13:91–99.
- . 1966. *Plethodon dorsalis*. Cat. Amer. Amphib. Rept. (29):1–3.
- Trauth, S.E., H.W. Robison, and M.V. Plummer. 2004. The Amphibians and Reptiles of Arkansas. Univ. Arkansas Press, Fayetteville.
- Watson, T. 2001. The influence of predation risk on the foraging and territorial behavior of the Ozark Zigzag Salamander (*Plethodon angusticlavius*). M.S. Thesis, Southwest Missouri St. Univ., Springfield.
- , A. Mathis, and R. Thompson. 2004. Influence of physical stress, distress cues, and predator kairomones on the foraging behavior of Ozark Zigzag Salamanders, *Plethodon angusticlavius*. Behav. Process. 65:201–209.
- Wiggs, R.L. and D.R. Angelo. 2003. A herpetofaunal inventory of Buffalo National River. Natl. Park Serv., Heartland Network Inv. Monit. Prog., Republic, Missouri.
- Wilkinson, R.F., C.L. Peterson, D. Moll, and T. Holder. 1993. Reproductive biology of *Plethodon dorsalis* in northwestern Arkansas. J. Herpetol. 27:85–87.

WALTER E. MESHAKA, JR., Section of Zoology and Botany, State Museum of Pennsylvania, 300 North Street, Harrisburg, PA 17120-0025, USA (wmeshaka@state.pa.us), and **STANLEY E. TRAUTH**, Department of Biological Sciences, Arkansas St. University, P.O. Box 599, State University, AR 72467-0599, USA (strauth@astate.edu).

Primary editor for this account, Brian T. Miller.

Published 15 February 2006 and Copyright © 2006 by the Society for the Study of Amphibians and Reptiles.
